Biodegradable microcontainers as an oral drug delivery system for poorly soluble drugs.

Nielsen, Line Hagner; Nagstrup, Johan; Keller, Stephan Sylvest; Gordon, Sarah; Østergaard, Jesper ; Rades, Thomas; Müllertz, Anette; Boisen, Anja

Published in:
Proceedings of the 2013 AAPS Annual Meeting

Publication date:
2013

Biodegradable microcontainers as an oral drug delivery system for poorly soluble drugs

Line Hagner Nielsen[1], Johan Nagstrup[2], Stephan Sylvest Keller[2], Sarah Gordon[3], Jesper Østergaard[1], Thomas Rades[1], Anette Müllertz[1,4], Anja Boisen[2]

[1]Department of Pharmacy, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark
[2]Department of Micro and Nanotechnology, Technical University of Denmark, Denmark
[3]Department of Drug Delivery, Helmholtz Institute for Pharmaceutical Research Saarland (HIPS), Saarland University, Saarbrücken, Germany
[4]Bioneer:FARMA, Department of Pharmacy, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark

PURPOSE: To fabricate microcontainers in biodegradable polylactic acid (PLLA) polymer films using hot embossing, and investigate the application of fabricated microcontainers as an oral drug delivery system for a poorly soluble drug.
METHODS: For fabrication of the PLLA microcontainers, a film of PLLA was produced by spin coating. The film was heated above the polymer glass transition temperature (T_g), and a stamp was forced into the film. Following cooling of the film the stamp was removed, exposing the formed microcontainers. Microcontainers were filled with amorphous furosemide sodium salt (produced by spray drying) using a simplified version of a screen printing technique. An enteric-resistant lid of Eudragit L-100 was subsequently spray coated onto the cavity of the microcontainers. Release of amorphous furosemide salt from the coated microcontainers was investigated using a µ-Diss profiler. Release experiments were carried out in biorelevant gastric medium (pH 1.6) for 2 h, followed by 3 h in a biorelevant intestinal medium (pH 6.5). Moreover, biorelevant flow through dissolution was also carried out in conjunction with UV imaging to visualize the release of amorphous furosemide salt from the coated microcontainers.
RESULTS: Fabricated PLLA microcontainers had an inner diameter of 220 µm and a height of 100 µm. The screen printing technique was shown to be an optimized set-up to fill the microcontainers with drug. From the release experiments it was observed that the Eudragit layer prevented drug release in biorelevant gastric medium, while an immediate release of the amorphous furosemide salt was seen in the biorelevant intestinal medium. The same trend was observed in the UV imaging experiments –negligible drug release was observed in gastric medium, whereas following re-equilibration of the dissolution cell with the intestinal medium, a release of furosemide was observed after 1 min with an increased release after 5 min of dissolution.
CONCLUSIONS: Biodegradable microcontainers were successfully fabricated and loaded with drug. Coating with Eudragit L-100 proved to be useful for protecting drug release from microcontainers in gastric medium, and facilitated an immediate release in the intestinal medium. The fabricated microcontainers therefore show considerable future potential as oral drug delivery systems.